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CITIZENSHIP : REPUBLIC OF KOREA

Translation of Priority Document

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Date of Application : April 15, 2003

Applicant(s) : Samsung Electronics Co., Ltd.

November 10, 2003

COMMISSIONER

ABSTRACT

1. Field of the Invention

The present invention relates to a ONT management control protocol of a Gigabit-capable passive optical network (hereinafter, referred to as GPON).

2. Substantial matter of the Invention

The present invention has been made to solve the above-mentioned problems occurring in the prior art, and an object of the present invention is to provide a GTC frame structure for ONT management control information transmission in Gigabit-capable
5 passive optical network (GPON) which can transmit the management control information to an ONT supporting an ATM mode and an ONT supporting an GEM mode, and transmission method of the information.

3. Point of the method for solving the problem of the Invention

A method for transmitting management control information from an OLT to an ONT in a Gigabit-capable passive optical network in the present invention is comprised of the
10 step (1) constructing a GTC frame which includes a PCBd portion having an OMCC field including either destination identifier information for supporting a GEM mode or destination identifier information for supporting a ATM mode, and a payload portion including data and the step (2) transmitting the GTC frame.

4. Important use of the Invention

The present invention is directed to being used for GPON.

[Representative Figure]

Fig. 5
20

[Index]

GPON, GEM, OLT, ONT, OMCI
25

[SPECIFICATION]**[TITLE OF THE INVENTION]**

5 GTC FRAME STRUCTURE FOR TRANSMITTING OMCI IN GPON AND
TRANSMITTING METHOD

[BRIEF DESCRIPTION OF THE DRAWINGS]

10 FIG. 1 is a block diagram of a conventional PON;
FIG. 2 is a view showing a protocol stack structure of a conventional GPON;
FIG. 3. is a view showing a structure of a frame transmitting ONT
management control information of a BPON defined by the G.983.2;
FIG. 4. is a view showing a structure of a frame in a GEM mode supporting a
15 conventional TDM and Ethernet service;
FIG. 5 is a view showing a structure of a GTC frame in a GPON according to
an embodiment of the present invention;
FIG. 6 is a view showing a structure of a GTC frame in a GPON according to
another embodiment of the present invention;
20 FIG. 7 is a view showing a structure of a GTC frame into which a flag field for
representing whether an OMCC field is included or not is inserted, in a GPON
according to an embodiment of the present invention; and
FIG. 8 is a view showing a protocol stack structure in the GPON according to
the embodiment of FIG. 6.

25 **[DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT]**

[OBJECT OF THE INVENTION]**[RELATED FIELD AND PRIOR ART OF THE INVENTION]**

The present invention relates to a ONT management control protocol of a Gigabit-capable passive optical network (hereinafter, referred to as GPON). In order to construct a subscriber network from a telephone office to a building or a general house, recently various network structures and progress schemes have been

proposed. For instance, a x-digital subscriber line (XDSL), a hybrid fiber coax (HFC), a fiber to the building (FTTB), a fiber to the curb (FTTC), or a fiber to the home (FTTH) have been proposed. From among these structures, an FTTx (x represents B, C, or H) structure may be classified into an active FTTx structure which is realized by construction of an active optical network (hereinafter, referred to as AON) and a passive FTTx structure which is realized by construction of a passive optical network (hereinafter, referred to as a PON).

Herein, since a PON, which is employed for realizing a passive FTTx, has a point-to-multipoint topology by passive elements, it is proposed as a scheme for realizing an economic subscriber network. That is, in the PON, one optical line termination (hereinafter, referred to as an OLT) is connected to a plurality of optical network units (hereinafter, referred to as a ONUs) by means of an optical distribution network (hereinafter, referred to as an ODN) of $1 \times N$, so that a distributed topology with a tree structure is formed.

A first type of PON developed and standardized was an asynchronous transfer mode passive optical network (hereinafter, referred to as an ATM-PON), and the standardization contents are written in the ITU-T G.982, ITU-T G.983.1 and ITU-T G.983.3 drawn up by the international telecommunication union's telecommunication section (ITU-T). At present, a GPON standardization is being developed by the ITU-T.

FIG. 1 is a block diagram of a conventional PON. Generally, the PON includes one OLT and a plurality of ONUs. FIG. 1 shows an example in which one OLT 10 is connected to three ONUs 12a to 12c through an ODN 16.

Referring to FIG. 1, the OLT 10 is located at a root of tree structure and plays a central role in providing information to subscribers in an access network. This OLT 10 is connected to the ODN 16. Herein, the ODN 16 has a tree topology structure, distributes a downstream data frame, which is transmitted from the OLT 10, to the ONUs 12a to 12c. Further, the ODN 16 multiplexes upstream data frames from the ONUs 12a to 12c and transmits the multiplexed frame to the OLT 10. Also, the ONUs 12a to 12c receives the downstream data frame, provides it to end users 14a to 14c, and

transmits data outputted from the end users 14a to 14c to the OLT 10 through the ODN 16 as upstream data frames. Herein, each of the end users 14a to 14c connected to the each of the ONUs 12a to 12c represents several kinds of terminating equipment of a subscriber network which can be used in a PON including network terminals (NTs).

5 Generally, in an ATM-PON, ATM cells, each of which has a size of 53 bytes, are transmitted upward or downward in the form of frames each consisting of a predetermined number of ATM cells. In a tree type PON structure as shown in FIG. 1, the OLT 10 properly inserts downstream cells in a downstream frame, and then the downstream cells are distributed to each of the ONUs 12a to 12c. Further, in the case
10 of upstream transmission, the OLT 10 accesses data, which are transmitted from the ONUs 12a to 12c, by means of a time division multiplexing (TDM) method. Herein, since the ODN 16, which is connected between the OLT 10 and the ONUs 12a to 12c, is a passive device, the OLT 10 prevents data from colliding in the ODN 16 by means of a virtual distance correction algorithm called "ranging". Further, when downstream
15 data transmission is performed from the OLT 10 to the ONUs 12a to 12c, the OLT 10 and the ONUs 12a to 12c can send or receive from each other a code key for an encryption and an operations, administration and maintenance (OAM) message for maintenance, in order to maintain security. For this purpose, each frame in upstream or downstream transmission has a corresponding data field arranged in a dedicated
20 ATM cell or a general ATM cell, by which a message can be sent or received at predetermined intervals.

A GPON according to the present invention simultaneously supports not only a cell-based transmission method (that is, an ATM mode) processing an ATM service, but also a GPON encapsulation method (that is, a GEM mode) processing packets
25 having varied length in a time division multiplex (TDM) and an Ethernet service. This is different from a broadband passive optical network (BPON), which is based on the G.983 series of which standardization has been completed as described above and operates on the basis of an ATM. Herein, in the ATM mode, transmission data is fitted to a GPON transmission convergence (hereinafter, referred to as a GTC) frame by the
30 unit of a cell and then transmitted. Further, in the GEM mode, transmission data is

1 fitted to a GTC frame by the unit of each GEM frame and transmitted.

FIG. 2 is a view showing a protocol stack structure of a conventional GPON. Referring to FIG. 2, the protocol stack of the GPON includes a protocol layer 100 which interfaces with an upper layer, a GTC layer 200, and a GPON physical media
5 dependent (GPM) layer 300. The protocol layer 100 an ATM client 110, an ONT management control interface (hereinafter, referred to as an OMCI) 120, a GEM client 130, and a physical layer operation administration maintenance (PLOAM) module 140.

In the GPON protocol having this structure, the GTC layer 200 converts upper frames into a GTC frame and then transmits the frame. Herein, the ATM client 110
10 supports a transmission method of an ATM mode, and the GEM client 130 supports a transmission method of an GEM mode.

The ATM client 110 fits transmission data to the GTC frame by the unit of a cell with a fixed length. In this case, if there is a portion, which has a length shorter than a length of a cell (typically, 53 bytes), in the GTC frame, the ATM client 110 fits
15 transmission data to the next frame and then transmits the frame. Accordingly, a cell is not divided in the ATM mode.

However, since a GEM frame is a packet having a varied length, when the GEM client 130 fits the GEM frame to the GTC frame, the GEM client 130 may divide the GEM frame and then transmits the divided frame, for efficient use of bandwidths.

20 For instance, when the GEM client 130 receives user data from an upper layer, the GEM client 130 receives information (e.g. length) about the GTC frame, which is standing by, from the GTC layer 200, divides the user data on the basis of the information, and generates a plurality of GEM frames. Otherwise, the GEM client 130 does not divide the user data, generates one GEM frame, and then transmits the
25 GEM frame to the GTC layer 200. Then, the GTC layer 200 fits the GEM frame to a GTC frame which is standing by and transmits the frame.

Also, a reception side reassembles the divided GEM frame and then transmits the frame to an upper layer.

In the prior art, there is an ONT management control protocol for a BPON.
30 The BPON operates on the basis of an ATM as defined by the G.983.1. Further, the

G.983.2 defines an ONT management control interface of the BPON. This BPON also operates on the basis of the ATM. The G.983.2 defines an ATM cell-based frame structure which can transmit the management control information.

FIG. 3. is a view showing a structure of a frame transmitting ONT management control information of a BPON defined by the G.983.2. Hereinafter, the frame constructed by fields will be in detail described.

First, an ATM header 301 represents a virtual path identifier (VPI) and a virtual channel identifier (VCI) which are channel addresses for management control.

Further, a transaction correlation identifier 302 represents a relation between a request message and a response message.

Further, a message type 303 represents the kinds of messages.

Further, a device identifier 304 represents a system (OxOA) based on the ITU-T G.983.1

Further, a message identifier 305 represents a managed entity and a managed entity instance.

Further, a message contents 306 represents the contents of a message defined by the message type 303.

FIG. 4. is a view showing a structure of a frame in a conventional GEM mode supporting a TDM and Ethernet service, in which only a structure for a TDM frame or an Ethernet frame is defined.

Referring to FIG. 4, the GEM frame generally includes a payload length identifier (hereinafter, referred to as a PLI)(L) (16 bits) 410, a Port ID (12 bits) 420, a frag (two bits) 430, a FFS (two bits) 440, a HEC (16 bits) 450, and a fragment payload (L byte) 460. Herein, the PLI 410, the Port ID 420, the frag 430, the FFS 440, and the HEC 450 are included in a GEM header.

The PLI 410 is a field for representing a length of a payload, and the Port ID 420 is a field for dividing traffic in order to provide a traffic multiplexing. Further, the Frag 430 is a field for representing division state of a payload, and the FFS 440 is a field for detecting and correcting a header error. The FFS 440 is an undecided field.

In the prior art, the two bits of the Frag 430 from among the GEM frame

header shows whether or not a currently transmitted GEM payload is a divided frame. For instance, the Frag 430 in an undivided GEM frame may be set as "11", the Frag 430 in a start frame of a divided GEM frame may be set as "10", the Frag 430 in a medium frame of the divided GEM frame may be set as "00", and the Frag 430 in a last
5 frame of the divided GEM frame may be set as "01", so that, whether or not a predetermined GEM frame is a divided frame, or one of the divided frames which corresponds to the predetermined GEM frame can be indicated.

Also, in a GPON which is being standardized by the ITU-T, one OLT communicates with a plurality of ONT (ONU). Herein, the OLT supplies both an
10 ATM mode and a GEM mode, and it selectively can transmit. However, it has been defined that the ONT (ONU) supplies only one mode. Further, the OLT needs an ONT management control interface to manage the ONTs (ONUs) connected to the OLT for communication. Herein, since the OLT and the ONTs (ONUs) communicate with each other by means of different modes, the ONT management control interface must
15 supply different modes.

A protocol defined by the ONT management control interface, which has been defined by the existing G.983.2, operates on the basis of an ATM. Accordingly, an ONT management control packet is transmitted by means of an ATM cell (reference to FIG. 3) with a length of 53 bytes. Herein, VPI/VCI values, which are channel
20 addresses for the ONT management control interface, are shown in the ATM header. Further, a cell payload transmits information such as the transaction correlation identifier 302, the message type 303, the device identifier 304, the message identifier 305, the message contents 306, and the AAL5 trailer 307. As described above, the ONT management control interface defined by the existing G.983.2 can be just applied
25 to the ONT (ONU) operated by an ATM mode.

However, the GPON is classified into and defined by an ONT management control interface of the GEM mode and an ONT management control interface of the ATM mode. Accordingly, the ONT management control interface of the ATM mode cannot be applied to the ONT (ONU) operated by an GEM mode.

30 As described above, a way capable of transmitting the ONT management

control interface has not been considered in the GEM protocol. Accordingly, the GEM protocol is required to have a definition about a mechanism which can transmit management control interface information.

In general, there are two methods in transmitting the OMCI information in a GPON supporting both a GEM payload and an ATM payload. One method is an in-band method in which a field is always assigned to a channel assigned to a header of a frame, etc. The other method is an out-of-band method in which a frame for the OMCI information is defined.

In the out-of-band method, the current G.983.2 intact can be used for the ATM mode, but an OMCI for a GEM mode must be newly defined.

In contrast, the in-band method has a limitation in a definition of the OMCI for the GEM mode, in that the OMCI of the GEM mode must use the G.983.2 standard intact or an OMCI field having the same size as that of an OMCI of the G.983.2 in order to use the current G.983.2, because the GPON supports both the GEM mode and the ATM mode. However, the in-band method has an advantage not only in view of always assigning a fixed channel, but also in view of compatibility with the standard because it does not define a new OMCI.

[SUBSTANTIAL MATTER OF THE INVENTION]

The present invention has been made to solve the above-mentioned problems occurring in the prior art, and an object of the present invention is to provide a GTC frame structure for ONT management control information transmission in Gigabit-capable passive optical network (GPON) which can transmit the management control information to an ONT supporting an ATM mode and an ONT supporting an GEM mode, and transmission method of the information.

That is, the present invention provides a method for transmitting ONT management control information, which can simultaneously support both an ATM mode and a GEM mode on the basis of an in-band method while supporting the existing G.983.2.

[CONSTRUCTION AND OPERATION OF THE INVENTION]

In order to accomplish the aforementioned objects, according to an embodiment of the present, there is provided a method for transmitting management control information from an OLT to an ONT in a Gigabit-capable passive optical network comprising the steps of: constructing a GTC frame which includes a PCBd portion having an OMCC field including either destination identifier information for supporting a GEM mode or destination identifier information for supporting a ATM mode, and a payload portion including data; and transmitting the GTC frame.

10 In order to accomplish the aforementioned objects, according to an embodiment of the present, there is provided a method for transmitting management control information from an ONT to an OLT in a Gigabit-capable passive optical network comprising the steps of: constructing a GTC frame which includes a PCBd portion having an OMCC field including either destination identifier information for supporting a GEM mode or destination identifier information for supporting a ATM mode, and a payload portion in which data are included; and transmitting the GTC frame.

In order to accomplish the aforementioned objects, according to an embodiment of the present, there is provided a GTC frame structure for transmitting management control information between an ONT and an OLT in a Gigabit-capable passive optical network comprising: a PCBd portion having an OMCC field which includes either destination identifier information for supporting a GEM mode or destination identifier information for supporting a ATM mode; and a payload portion including data.

25 Hereinafter, a preferred embodiment according to the present invention will be described with reference to the accompanying drawings. In the following description of the present invention, a detailed description of known functions and configuration incorporated herein will be omitted when it may make the subject matter of the present invention rather unclear.

30 An ONT management control interface (hereinafter, referred to as an OMCI) is

a protocol for an ONU (ONT) management, and it is a kind of an operations, administration and maintenance (hereinafter, referred to as an OAM) specification. According to the standard G.983.2, a field of an OMCI for a BPON can be classified into a configuration management, a fault management, a performance management, and
5 a security management, etc. Further, a method for sending and receiving a control message (that is an OMCI message), each message type, and a necessary attribute have been defined according to each field.

That is, the OMCI may be called a kind of management system protocol for providing services of upper layers (above a GTC). Accordingly, since an OMCI of a
10 GPON supports not only an ATM mode but also a GEM mode, it is necessary to establish an OMCI for the GEM mode. For this purpose, the present invention realizes it on the basis of the G.983.2.

FIG. 5 is a view showing a structure of a GTC frame in a GPON according to an embodiment of the present invention. As shown in FIG. 5, an OMCI channel is
15 added to a GPON transmission convergence (hereinafter, referred to as a GTC) frame structure defined by the "G.GPON.GTC".

First, the GTC frame in the GPON can be classified into a physical control block downstream (hereinafter, referred to as a PCBd) field 500 and a payload field 510. In the present invention, a construction for a downstream from an OLT to an ONT
20 employs the PCBd field 500 as an example. Also, the same construction can be employed in an upstream from an ONT to an OLT.

In the GTC frame structure, the PCBd field 500 is a header including a PSync field 51 for general synchronization, an Ident field 52 representing a FEC use state and a key-switching state for an indication of a frame having a long length, a physical layer
25 operations and maintenance (PLOAM) field 53, and a bandwidth allocation/report structure, etc.

Further, the payload field 510 includes data transmitted by the GTC frame.

In the present invention, the PCBd field 500 includes an ONT management control channel (hereinafter, referred to as an OMCC) field 54 for transmitting OMCI
30 information. Further, the OMCC field 54 includes a destination virtual path identifier

(hereinafter, referred to as a VPI)/virtual channel identifier (hereinafter, referred to as a VCI) in order to support an ATM mode, or at least has a field 55 including a Port ID in order to support an GEM mode. That is, the present invention includes the destination VPI/VCI into the PCBd portion in order to support an ATM mode, or adds the OMCC field including the Port ID in order to support an GEM mode. Herein, the contents, size and position of the OMCC field will not be in detail described in the present invention, but it basically conforms to the G.983.2. That is, the transaction correlation identifier 302, the message type 303, the device identifier 304, the message identifier 305, and the message contents 306 shown in FIG. 3 may be included.

10 Herein, since the frame shown in FIG. 4 is OMCI information for the ATM mode, a Port_ID is used in the case of OMCI information for the GEM mode.

Further, since the OMCC field 54 is not always transmitted but may be inserted as occasion demands, a flag bit can be inserted, which is necessary for representing whether a corresponding field has been inserted or not. This will be described in more detail with reference to FIG. 7.

FIG. 6 is a view showing a structure of a GTC frame in a GPON according to another embodiment of the present invention. As shown in FIG. 6, an OMCI channel is added to a GTC frame structure defined by the "G.GPON.GTC".

First, the GTC frame in the GPON is classified into a physical control block downstream (hereinafter, referred to as a PCBd) field 500 and a payload field 510.

In the GTC frame structure, the PCBd field 500 is a header including a PSync field 51 for general synchronization, an Ident field 52 representing a FEC use state and a key-switching state for an indication of a frame having a long length, a physical layer operations and maintenance (PLOAM) field 53, and a bandwidth allocation/report structure, etc.

Further, the payload field 510 includes data transmitted by the GTC frame. In the present invention, the PCBd field 500 includes an ONT management control channel (hereinafter, referred to as an OMCC) field 54 for transmitting OMCI information.

30 Herein, in the present embodiment, the OMCC field 54 uses an ONU_ID 61.

instead of a VPI/VCI or a Port_ID, as an identifier for classifying a destination of the OMCC field 54.

That is, since an OMCI in the OMCC field 54 employs an ONT(or ONU) as a control subject, the OMCC field 54 uses the ONU_ID 61 as the destination identifier.

5 Especially, differently from the embodiment of FIG. 5 in which different destination identifiers are used according to the ATM mode or the GEM mode, the present embodiment uses one ID regardless of support modes, so that a field format of the OMCC can be simplified. Furthermore, according to the present embodiment, since the ONU_ID can be extracted directly from the GTC framing sublayer shown in
10 FIG. 2 without passing through a TC adaptation sublayer.

As described above, even in the present embodiment, the OMCC field including the ONU_ID field 61 is added to the PCBd field 500 of the GTC frame. Herein, a contents, size and position of the OMCC field will not be in detail described in the present invention, but it basically conforms to the G.983.2. That is, the
15 transaction correlation identifier 302, the message type 303, the device identifier 304, the message identifier 305, and the message contents 306 shown in FIG. 3 may be included.

Further, since the OMCC field 54 is not always transmitted but may be inserted as occasion demands, a flag bit can be inserted, which is necessary for
20 representing whether a corresponding field has been inserted or not. This will be described in more detail with reference to FIG. 7.

FIG. 7 is a view showing a structure of a GTC frame into which a flag field for representing whether an OMCC field is included or not is inserted, in a GPON according to an embodiment of the present invention.

25 In the present embodiment, an OMCC indic field 73 is added to the Ident field 52 described with reference to FIGs. 5 and 6 so that an existence or absence of insertion of the OMCC field can be determined according to a value of the OMCC indic field 73. Further, a key indic field 71 represents information about a key-switching, and a forward error control (hereinafter, referred to as a FEC) indic field 72 represents
30 information about whether or not the FEC is used.

While the invention has been shown and described with reference to certain preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

- 5 A construction for downstream from an OLT to an ONT is described with reference to embodiments in FIGs. 5 to 8, but a construction for upstream from an ONT to an OLT can be also described by the same manner. That is, in the case of upstream from an ONT to an OLT, a physical control block upstream (hereinafter, referred to as a PCBu) field having the same structure as that of the PCBd is employed. Accordingly,
10 the description of FIGs. 5 to 8 are applied to the PCBu field.

[EFFECT OF THE INVENTION]

In the present invention as described above, by means of a GTC frame in which an OMCC field including OMCI information is added, a mechanism can be provided, which can exchange control information regarding an ATM mode client or a GEM mode client. That is, in a GPON, an OLT can manage/control not only an ONT operated in an ATM mode, but also an ONT operated in an GEM mode.

[WHAT IS CLAIMED IS]

1. A method for transmitting management control information from an OLT to an ONT in a Gigabit-capable passive optical network, the method comprising the steps of:

5 constructing a GTC frame which includes a PCBd portion having an OMCC field including either destination identifier information for supporting a GEM mode or destination identifier information for supporting a ATM mode, and a payload portion including data; and
transmitting the GTC frame.

10 2. The method as claimed in claim 1, wherein the PCBd portion further includes an OMCC flag field for determining whether the OMCC field is inserted or not.

3. The method as claimed in claim 1 or 2, wherein, when a mode of the ONT
15 is the GEM mode, a Port ID is used as the destination identifier information for supporting the GEM mode of the OMCC field.

4. The method as claimed in claim 1 or 2, wherein, when a mode of the ONT is the ATM mode, VPI/VCI are used as the destination identifier information for
20 supporting the ATM mode of the OMCC field.

5. The method as claimed in claim 1 or 2, wherein an ONT ID is used as the destination identifier information.

25 6. The method as claimed in claim 2, wherein one bit in an Ident field defined by the G.GPON.GTC is used as the OMCC flag field.

7. A method for transmitting management control information from an ONT to an OLT in a Gigabit-capable passive optical network, the method comprising the steps

of:

constructing a GTC frame which includes a PCBd portion having an OMCC field including either destination identifier information for supporting a GEM mode or destination identifier information for supporting a ATM mode, and a payload portion in
5 which data are included; and
transmitting the GTC frame.

8. The method as claimed in claim 7, wherein the PCBd portion further includes an OMCC flag field for determining whether the OMCC field is inserted or
10 not.

9. The method as claimed in claim 7 or 8, wherein, when a mode of the ONT is the GEM mode, a Port ID is used as the destination identifier information for supporting the GEM mode of the OMCC field.

15

10. The method as claimed in claim 7 or 8, wherein, when a mode of the ONT is the ATM mode, VPI/VCI are used as the destination identifier information for supporting the ATM mode of the OMCC field.

20 11. The method as claimed in claim 7 or 8, wherein an ONT ID is used as the destination identifier information.

12. The method as claimed in claim 8, wherein one bit in an Ident field defined by the GGPON.GTC is used as the OMCC flag field.

25

13. A GTC frame structure for transmitting management control information between an ONT and an OLT in a Gigabit-capable passive optical network, the structure comprising:

a PCBd portion having an OMCC field which includes either destination
30 identifier information for supporting a GEM mode or destination identifier information

for supporting a ATM mode; and
a payload portion including data.

14. The GTC frame structure as claimed in claim 13, wherein the PCBd
5 portion further includes an OMCC flag field for determining whether the OMCC field
is inserted or not.

15. The GTC frame structure as claimed in claim 13 or 14, wherein, when a
mode of the ONT is the GEM mode, a Port ID is used as the destination identifier
10 information for supporting the GEM mode of the OMCC field.

16. The GTC frame structure as claimed in claim 13 or 14, wherein, when a
mode of the ONT is the ATM mode, VPI/VC1 are used as the destination identifier
information for supporting the ATM mode of the OMCC field.

15

17. The GTC frame structure as claimed in claim 13 or 14, wherein an ONT
ID is used as the destination identifier information.

18. The GTC frame structure as claimed in claim 14, wherein one bit in an
20 Ident field defined by the G.GPON.GTC is used as the OMCC flag field.

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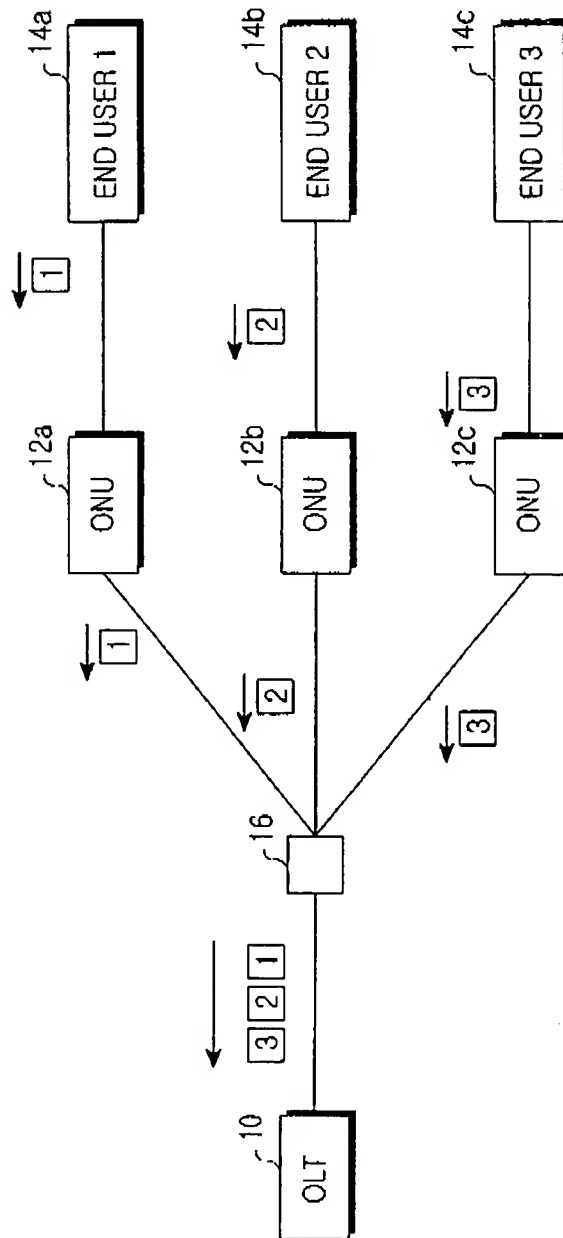


FIG.1

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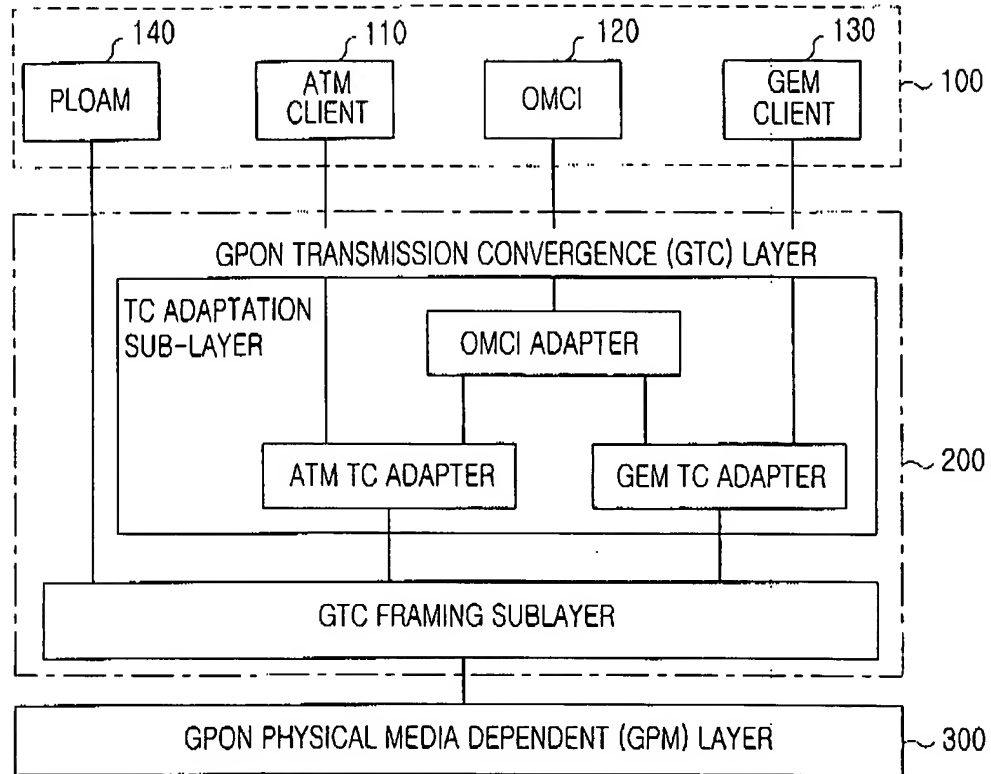


FIG.2

ATM HEADER (301)	Transaction Correlation Identifier (302)	MESSAGE TYPE (303)	DEVICE IDENTIFIER (304)	MESSAGE IDENTIFIER (305)	MESSAGE CONTENTS (306)	AAL5 TRAILER (307)
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FIG.3

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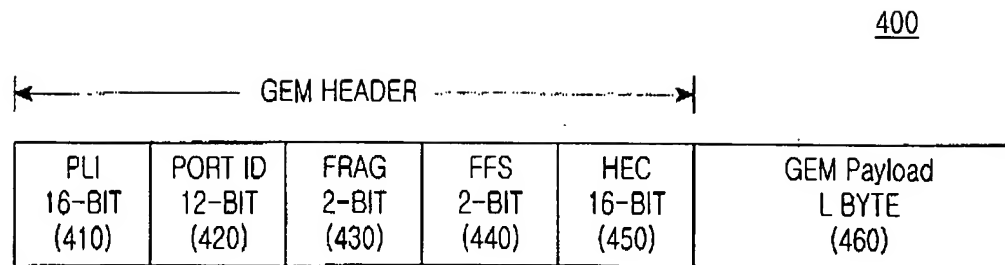


FIG.4

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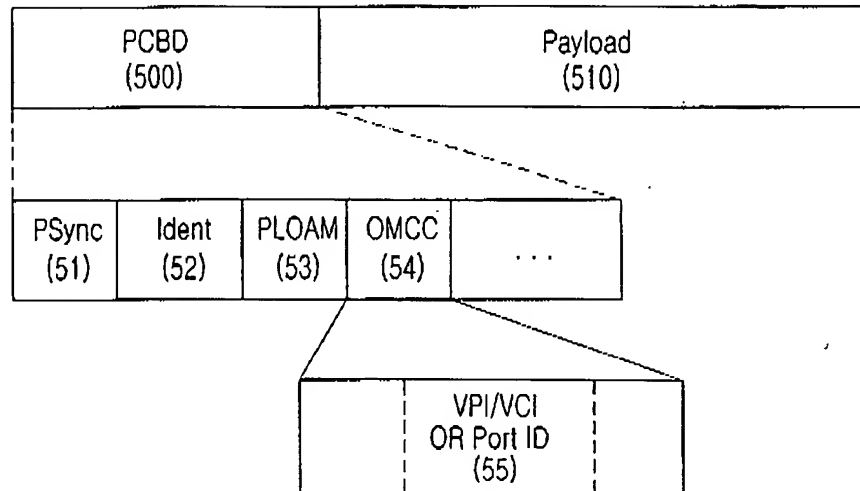


FIG.5

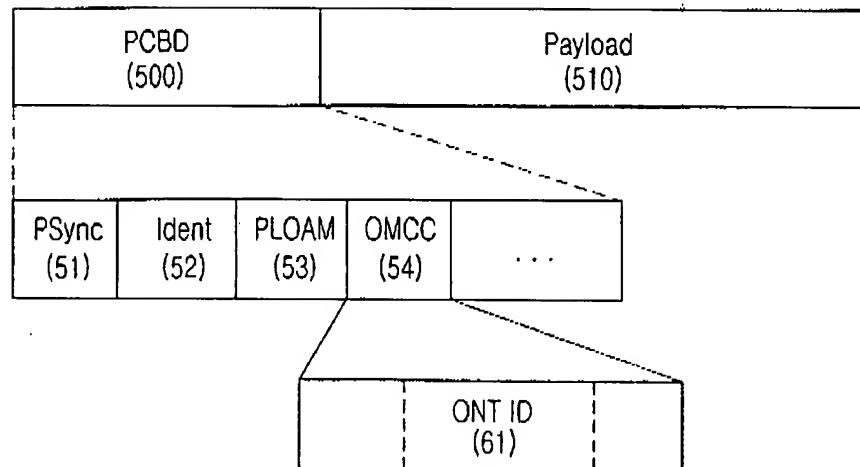


FIG.6

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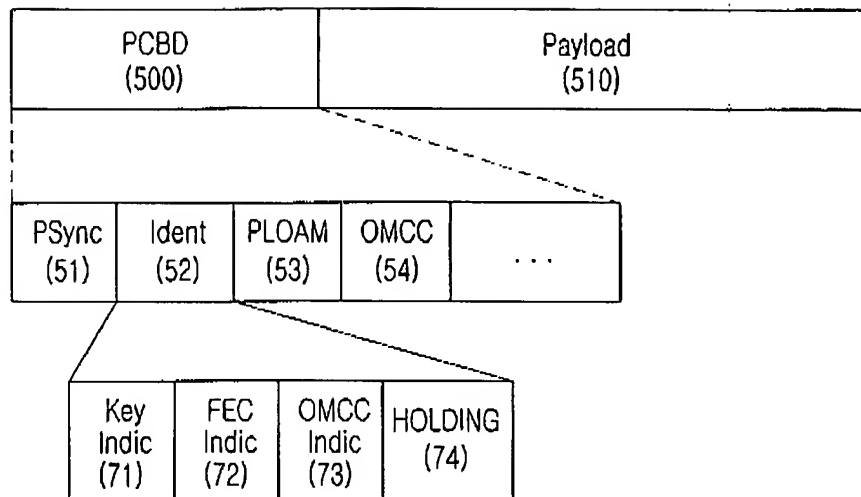


FIG.7

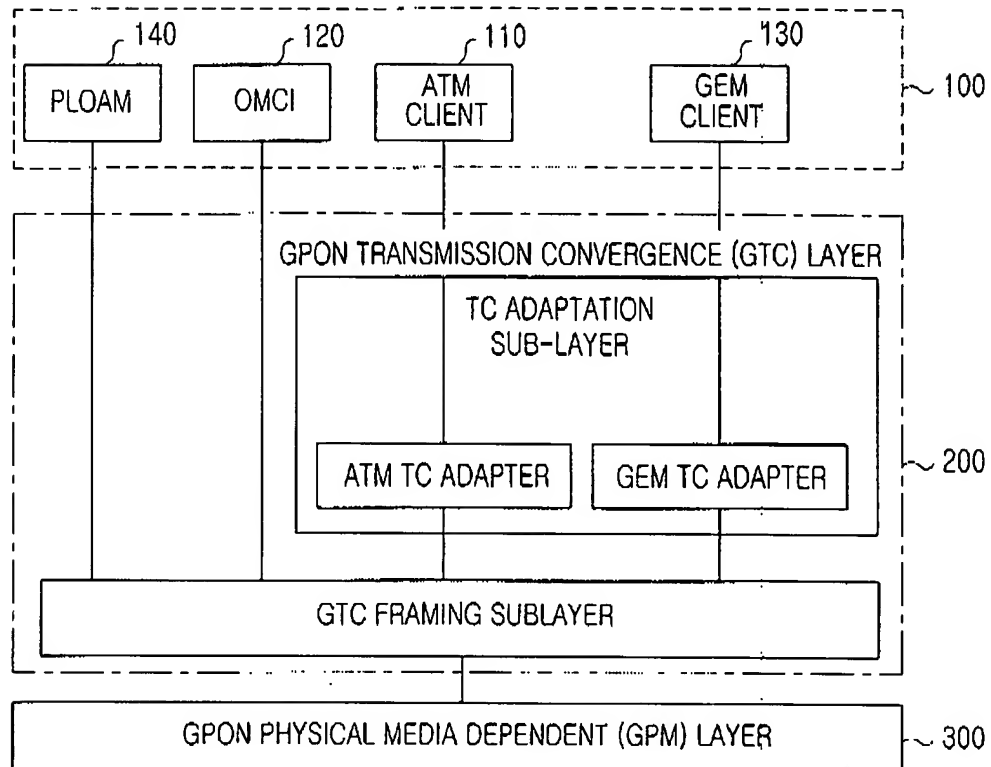


FIG.8